# PLANT SITE SURFACE WATER SUMMARY
# ASARCO EAST HELENA PLANT



This summary considers surface water features in the vicinity of the Asarco East Helena Plant* ("the plant"). These features consist of the following:

- Prickly Pear Creek and Upper Lake
- Wilson Ditch
- Storm Water Runoff

For purposes of this summary, each surface water feature is discussed separately and each discussion is structured as follows:

- Investigations and Methods
    - RI/FS Data
    - Post-RI/FS Data
- Results of Investigations
    - RI/FS Results
    - Post-RI/FS Results
- Remedial Alternatives
    - Alternatives Considered in the RI/FS
    - Alternatives Recommended in the RI/FS
    - Selected Remedial Alternative

* Lower Lake, a former process pond will be discussed in detail in the Process Fluids presentation.

# PRICKLY PEAR CREEK AND UPPER LAKE

## Investigations and Methods

### RI/FS Data

The RI/FS investigation was conducted from 1984 through 1987. Investigation methods included:

- Flow measurements (1984 through 1987)
- Water quality sampling (1984 through 1987)
- Bottom sediment sampling (November 1984 and June 1987)
- Off-Site Erosion and Transport Study (for Prickly Pear Creek - 1987)

### Post-RI/FS Data

- Surface water flow and water quality samples have been collected biannually at selected surface water sites on Prickly Pear Creek since 1991.
- Supplemental samples were collected from Prickly Pear Creek as part of Process Ponds Remediation Action Specific Monitoring Efforts.

# Results of Investigations

## RI/FS Results

### Prickly Pear Creek and Upper Lake - Water Flow and Water Quality

- Streamflow measured during 1984 through 1987 averaged 41 cfs 1.2 miles upstream of the plant site (site PPC-3) and 18 cfs 1.0 mile downstream of the plant site (site PPC-9). Irrigation ditches including Wilson Ditch near Upper Lake, and several irrigation ditches north and east of East Helena remove flow from Prickly Pear Creek during summer and fall. A small portion of the water diverted to Upper Lake is also used by the plant. Prickly Pear Creek generally is dry downstream of the irrigation ditches during late summer and fall.

- Prickly Pear Creek water quality upstream of the plant site is generally good but contains some arsenic and metals as a result of historic upstream mining and land disturbances. Trace element values at site PPC-3 in June of 1985, tabulated below, are typical of upstream water quality.

| Parameter | Total Values (mg/L) |
|---|---|
| Arsenic | 0.007 |
| Cadmium | 0.003 |
| Copper | 0.011 |
| Lead | 0.007 |
| Zinc | 0.063 |

- Groundwater seepage across the berm from Lower Lake to Prickly Pear Creek was shown to be a minor source of arsenic to Prickly Pear Creek. Specifically, the instream dissolved arsenic concentration was shown to increase from 0.007 mg/l to 0.02 mg/l between surface water stations PPC-3 (upstream) and PPC-7 (downstream) in June 1985.

| Parameter | PPC-3 Total Value (mg/L) | PPC-7 Total Values (mg/L) |
|---|---|---|
| Arsenic | 0.007 | 0.024 |
| Cadmium | 0.003 | <0.003 |
| Copper | 0.011 | <0.015 |
| Lead | 0.007 | 0.018 |
| Zinc | 0.063 | 0.076 |

RI/FS data
LL much cleaner now

- With the exception of impacts from Lower Lake, measurable arsenic and metal increases to Prickly Pear Creek water quality, as a result of plant operations, were not observed.

**Prickly Pear Creek and Upper Lake-Sediment Data**

- Sediment sampling results from Prickly Pear Creek showed metals were highest at stations adjacent to and downstream of the plant site (sites PPC-5 through PPC-9). Concentration ranges were:

from PPCreek dam on down

| Parameter | Min (mg/kg) | Max (mg/kg) | Average (mg/kg) |
|---|---|---|---|
| Arsenic | 10 | 84 | 31 |
| Copper | 1 | 19 | 7 |
| Cadmium | 23 | 195 | 60 |
| Lead | 60 | 1450 | 374 |
| Zinc | 185 | 2650 | 717 |

- Upper Lake bottom ~~sediment concentrations~~ were higher than those measured at all sites in Prickly Pear Creek. This is likely a result of the historic deposition of arsenic and metal bearing sediments in Upper Lake from pre-1950's upstream mining disturbances and tailings in the Prickly Pear Creek drainage.

| Parameter | Min (mg/kg) | Max (mg/kg) | Average (mg/kg) |
|---|---|---|---|
| Arsenic | 75 | 264 | 141 |
| Copper | 112 | 330 | 241 |
| Cadmium | 12 | 65 | 42 |
| Lead | 685 | 4150 | 2062 |
| Zinc | 825 | 2550 | 1833 |

**Prickly Pear Creek - Soil Erosion Potential and Sediment Transport**

- Based on Universal Soil Loss Equation (USLE) calculations made during the soil erosion and transport investigation, the highest potential for soil transport to Prickly Pear Creek is from the steep, heavily dissected farmed area south of East Helena. The potential for sediment and metal transport to the creek from drainage areas around the plant site is relatively insignificant compared to plowed agricultural lands south of East Helena.

How do they reach this conclusion are metal concentration at agricultural lands the same as concentrations onsite

Concentrations are much lower, but mass of soils so much higher Asarco's contribution is minimal

## Post-RI/FS Results

### Prickly Pear Creek Water Quality

- Data from biannual samples collected at surface water sites along Prickly Pear Creek were summarized in a September 1995 report titled "ASARCO East Helena Post-RI Well and Surface Water Monitoring Report (1990-1994).

- Water quality was similar to that sampled during the RI/FS. No significant changes to Prickly Pear Creek over time were observed for arsenic, the primary element of concern. Similar to the RI, arsenic concentrations were shown to be elevated at sites downstream (represented by PPC-7) from Lower Lake when compared to upstream concentrations (represented by PPC-3).

### Data from May 1997 Sampling Event

| Parameter | PPC-3 Total Values (mg/L) | PPC-7 Total Values (mg/L) |
|---|---|---|
| Arsenic | 0.008 | 0.01 |
| Cadmium | <0.001 | 0.001 |
| Copper | 0.015 | 0.017 |
| Lead | 0.02 | 0.024 |
| Zinc | 0.212 | 0.19 |

As ~~mean~~ dl - max .089

Similar to earlier values

some values range to 2x

highest Pb .11 (total) As .089 } measured values at prickly pear creek below plant



Scott: There is some metals enrichment as they go by the plant don't know why it hasn't been pursued further. What is the state goal

# Remediation Alternatives

## Remedial Actions Considered in the RI/FS

- The No Action specific alternative for Prickly Pear Creek or Upper Lake. Excluding anticipated decreases in arsenic concentrations associated with remediation of Lower Lake (part of the Process Pond remediation), existing water quality and sediment conditions would remain the same.

- Installation of a concrete channel berm where Prickly Pear Creek is in contact with the east edge of the slag pile to reduce the potential of slag erosion during periods of high runoff.

## Remedial Actions Recommended in the RI/FS

- The No Action alternative was recommended for Prickly Pear Creek because there were no significant impacts from the Slag Pile and because remediation of Lower Lake (part of the remedial actions for Process Ponds) would correct or mitigate water quality issues associated with the seepage of Lower Lake water across the berm that separates the berm from Prickly Pear Creek.

- No Action also applied to Upper Lake because the water quality is not impacted by plant activities.

## Selected Remedial Alternative

A remedy has not been selected.

# WILSON DITCH

## Investigations and Methods

### RI/FS Data

The RI/FS investigation was conducted from 1984 through 1987. Investigation methods included:

- Flow measurements (1984, 1985)
- Water quality sampling (1984, 1985)
- Bottom sediment sampling (1984, 1985, 1987)

### Post-RI/FS Data

Data collected subsequent to the RI/FS included:

- Water quality sampling (1993)

What are the State WQ standards for PP creek?

Has impact from the site been adequately characterized?

**Results of Investigations**

## RI/FS Results

- Wilson Ditch receives water from Upper Lake which, in turn, receives water from a diversion of Prickly Pear Creek. The water quality in Upper Lake, Prickly Pear Creek above the plant site, and the headgate of Wilson Ditch are basically the same.

- Typical water quality in Wilson Ditch downstream of the plant (site WD-2) for June 1985, is tabulated below.

| Parameter | Total Value (mg/L) |
|---|---|
| Arsenic | 0.018 |
| Cadmium | 0.004 |
| Copper | 0.016 |
| Lead | 0.075 |
| Zinc | 0.073 |

- Surface sediment samples (0-4"), collected in 1984, 1985 and 1987 from Wilson Ditch at sites downstream of the plant (WD-2, WD-3, WD-4 and WD-5), showed arsenic and metal concentrations higher than those in Upper Lake.

| Parameter | Min (mg/kg) | Max (mg/kg) | Average (mg/kg) |
|---|---|---|---|
| Arsenic | 169 | 2650 | 933 |
| Copper | 87 | 850 | 461 |
| Cadmium | 68 | 300 | 190 |
| Lead | 889 | 6528 | 3370 |
| Zinc | 903 | 4865 | 2614 |

## Post-RI/FS Results

- Water quality was monitored at three sites (WD-2, WD-3 and WD-4) along Wilson Ditch in May 1993.

### May 1993 Water Quality

| Parameter | Total Value (mg/L) | | |
|---|---|---|---|
| | Min | Max | Mean |
| Arsenic | 0.046 | 0.26 | 0.104 |
| Cadmium | 0.013 | 0.09 | 0.034 |
| Copper | 0.014 | 0.035 | 0.023 |
| Lead | 0.06 | 0.15 | 0.104 |
| Zinc | 0.09 | 0.285 | 0.171 |

# Remediation Alternatives

## Alternatives Considered in the RI/FS

- No Action
- Institutional restrictions and public education. Post information legally mandating that Wilson Ditch be off-limits to public access
- Fencing Wilson Ditch where access was easy and available. The ditch fence would extend from the Asarco plant to across Highway 12.
- Line Wilson Ditch from the plant site to Highway 12 with concrete to prohibit exposure to bottom sediments.
- Excavate the upper 1.5 feet of sediment in Wilson Ditch from the Asarco plant to across Highway 12 and dispose of sediments in a landfill.
- Excavate the upper 1.5 feet of sediment in Wilson Ditch from the Asarco plant to across Highway 12 and landfarm sediments.
- Replace the open portion of Wilson Ditch between the Asarco plant and Highway 12 with an underground pipe line and backfill the replaced portion of the existing ditch to prevent contact with bottom sediments.
- Excavate the upper 1.5 feet of sediment in Wilson Ditch from the Asarco plant to across Highway 12 and smelt the sediments.
- Treat sediments in-situ to immobilize metals.

- Excavate the upper 1.5 feet of sediment in Wilson Ditch from the Asarco plant to across Highway 12, treat the sediments by chemical fixation, and dispose on-plant or in the East Fields.

- Back fill 4000 feet of Wilson Ditch downstream of the plant to prevent potential exposure to metals in bottom sediments. An alternate irrigation diversion would provide irrigation water to users downstream of the backfilled portion.

**Alternatives Recommended in the RI/FS**

- Back fill 4000 feet of Wilson Ditch below the plant to prevent potential exposure to metals in bottom sediments. An alternate irrigation diversion would provide irrigation water to downstream users of the backfilled portion.

**Selected Remedial Alternative**

- EPA prepared an Engineering Evaluation/Cost Assessment (EE/CA) for Residential Soils and Wilson Ditch in May 1991. EPA's selected alternative as a result of the EE/CA was excavation of Wilson Ditch sediments and stockpiling in Asarco's East Fields.

- Wilson Ditch sediments were to be excavated as part of the Residential Soil Removal Action initiated in July 1991.

- Wilson Ditch sediments with elevated arsenic and metals concentrations were excavated in 1992 and 1993.

- The excavated ditch sediments were hauled to the East Field site where they were mixed with previously stockpiled residential soils which had been removed from East Helena.

- In 1995 and 1996, stock piled soils, including Wilson Ditch sediments, were spread and tilled into the East Fields site.

- In 1997, the on-plant portion of Wilson Ditch was re-routed around the plant site in a 27-inch diameter buried HDPE pipeline. This new pipeline replaced an existing 30-inch diameter reinforced concrete pipeline which was routed through the plant. This was a voluntary action by Asarco. Construction was completed in July 1997.

high concentrations of as + Pb in sediments N of Hwy 12 has not been addressed since no residences

# STORM WATER RUNOFF

## Investigations and Methods

### RI/FS Data

The RI/FS consisted of the following:

- Drainage mapping on the plant site (1987).

### Post-RI/FS Data

- Semi-annual sampling in compliance with the plant's MPDES storm water discharge permit. This sampling was initiated in May 1993 and is scheduled to be concluded with Montana DEQ concurrence, in late 1997 when new storm water containment facilities become operational.

- One snowmelt runoff water sample was collected in late winter 1995 for treatability (removal of suspended sediments) testing.

# Results of Investigations

## RI/FS Results

- Although storm water has the potential to leave the site during a large storm event, no surface water runoff was observed to enter Prickly Pear Creek during the RI/FS monitoring period. This occurred because the central portion of the plant is configured to capture storm water for use in the plant's water system. Other storm water runoff is known to pond in the vicinity of the inactive zinc plant where the ponded water seeps into underlying soils, eventually reaching the shallow groundwater system. Last, storm water which leaves the northwest portion of the plant is discharged to a topographic low point adjacent to nearby Montana Rail Link (MRL) tracks and monitored under the conditions of an MPDES storm water discharge permit.

- Plant site storm water runoff samples were collected at four locations (designated A, B, C, and D) in 1985 and at five locations (designated A, E, F, G, and H) in 1987. With the exception of sites A and D, which were located immediately outside the plant, all sample locations were inside the plant boundary. Grab samples were collected at each site and consequently, flow was not measured. All samples had low levels of dissolved metals but, elevated total metals and suspended sediment.

| Parameter | Total Concentration | | |
|---|---|---|---|
| | Min (mg/L) | Max (mg/L) | Mean (mg/L) |
| Arsenic | 1.63 | 380 | 75 |
| Cadmium | 0.525 | 68 | 16.8 |
| Copper | 2.85 | 1200 | 269 |
| Lead | 24.6 | 1600 | 328 |
| Zinc | 7.88 | 544 | 126 |
| TSS | 393 | 432 | 2112 |

- Results from the double ring infiltrometer tests in runoff sediment catch basins indicate low percolation rates of 0.03 cm/hr to 5.0 cm/hr.

## Post-RI/FS Results

- Plant site runoff samples, collected after the RI/FS, showed elevated total arsenic and metals. These samples were collected for the Montana Industrial Activity Permit No. MTR 000072 under the MPDES. Discharge data and summary water quality results (calculated using both first flush and composite sample results) are tabulated below.

### Summary of Storm Water Discharge Data

| | Outfall No. 1 | | | Outfall No. 2 | | |
|---|---|---|---|---|---|---|
| Sample Date | Peak Stage (feet) | Peak Discharge (gpm) | Total Runoff (gallons) | Peak Stage (feet) | Peak Discharge (gpm) | Total Runoff (gallons) |
| May 4, 1993 | -- | 10* | -- | -- | 800* | -- |
| April 19, 1994 | 0.06 | 3.48 | -- | 0.01 | 0.6 | -- |
| October 11, 1994 | 0.01 | 3.4 | 183.2 | 0.22 | 25.02 | 2174 |
| May 7, 1995 | 0.29 | 50.3 | 4448 | 0.34 | 75.3 | 3573 |
| July 29, 1995 | 0.12 | 5.39 | 1403 | 0.16 | 11.18 | 712 |
| May 16, 1996 | 0.44 | 144.6 | 10997 | 0.60 | 316.8 | 23656 |
| July 18, 1996 | -- | 42** | 3232** | -- | 88** | 5652** |

* Maximum Recorded Flow
** Estimated

## Data Collected at Outfall No. 2, 1993 Through 1996*

| Parameter (total concentration) | Min (mg/L) | Max (mg/L) | Average (mg/L) |
|---|---|---|---|
| Arsenic | 0.104 | 4.7 | 1.45 |
| Copper | <0.015 | 17.9 | 3.91 |
| Cadmium | 0.279 | 16.6 | 3.44 |
| Lead | 121 | 43.6 | 14.57 |
| Zinc | 0.51 | 34.5 | 7.92 |
| TSS | 20 | 1810 | 579 |

It should be noted that RI/FS runoff samples were collected at various locations within the plant site while post RI/FS runoff is monitored at two established stations immediately outside the plant boundary. The RI/FS storm water sampling sites do not coincide with the post RI/FS storm water sampling sites.

* In 1993, water quality data were collected at both Outfall No. 1 and Outfall No. 2. Due to the similarity in water quality data between Outfall No. 1 and Outfall No. 2, after 1993, water quality data were collected at Outfall No. 2 only.

become non-discharging. Construction of the proposed storm water control improvements was initiated in May 1997 and is scheduled to be completed in October 1997.

- Storm water originating on the plant is diverted to one of three areas for disposal. Storm water originating in the Central area of the plant is intercepted by the existing storm sewer, routed to the existing Tank Farm and ultimately treated via the HDS plant and discharged to Lower Lake. Storm water originating on the employee parking area flows to a topographically low area where it infiltrates into underlying soils. Storm water leaving the plant discharges from the northwest corner of the plant where it is monitored in accordance with the plant's MPDES storm water discharge permit. Construction of storm water improvements will be completed in late 1997, storm water leaving the plant will be intercepted and diverted through sediment basins to a storm water facility designed to contain and treat runoff from the 25-year, 24 hour storm event. Any overflow from this tank will be discharged to a topographically low area west of the plant where it will evaporate or infiltrate into underlying soils. This topographic low, when combined with on-plant facilities, will contain all plant runoff up to an including the 100-year, 24 hour storm event.

## Remediation Alternatives

### Alternatives Considered in the RI/FS

- Storm water runoff was part of the Lower Lake alternative actions that were evaluated as part of the Process Pond Operable Sub-unit FS. Lower Lake remedial actions are not discussed further here but, will be discussed as part of the Process Fluids presentation on August 25.

- Evaluated alternatives that included storm water runoff were:

    * No Action

    * Construct a lined pond on the north end of the plant property for emergency containment of storm runoff. This action was paired with construction of a tank farm to replace Lower Lake.

    * Use tanks to contain storm runoff.

### Alternatives Recommended in the RI/FS

- Construct a lined pond on the north end of the plant property for emergency containment of storm runoff

### Selected Remedial Alternative

- The Process Pond ROD (November 1989) Remedial Actions included construction of a lined pond to contain storm runoff.

- Based on several subsequent discussions with EPA and Montana DEQ representatives, Asarco selected a steel tank with secondary containment in lieu of a lined pond.

- In May 1996, the Montana DEQ submitted a letter to the EPA stating its opinion that site storm water can be adequately controlled under Montana's storm water permit program and that when the proposed improvements are installed, the facility will, for all practical purposes, become non-discharging. Construction of the proposed storm water control improvements was initiated in May 1997 and is scheduled to be completed in October 1997.

- Storm water originating on the plant is diverted to one of three areas for disposal. Storm water originating in the Central area of the plant is intercepted by the existing storm sewer, routed to the existing Tank Farm and ultimately treated via the HDS plant and discharged to Lower Lake. Storm water originating on the employee parking area flows to a topographically low area where it infiltrates into underlying soils. Storm water leaving the plant discharges from the northwest corner of the plant where it is monitored in accordance with the plant's MPDES storm water discharge permit. Construction of storm water improvements will be completed in late 1997, storm water leaving the plant will be intercepted and diverted through sediment basins to a storm water facility designed to contain and treat runoff from the 25-year, 24 hour storm event. Any overflow from this tank will be discharged to a topographically low area west of the plant where it will evaporate or infiltrate into underlying soils. This topographic low, when combined with on-plant facilities, will contain all plant runoff up to an including the 100-year, 24 hour storm event.